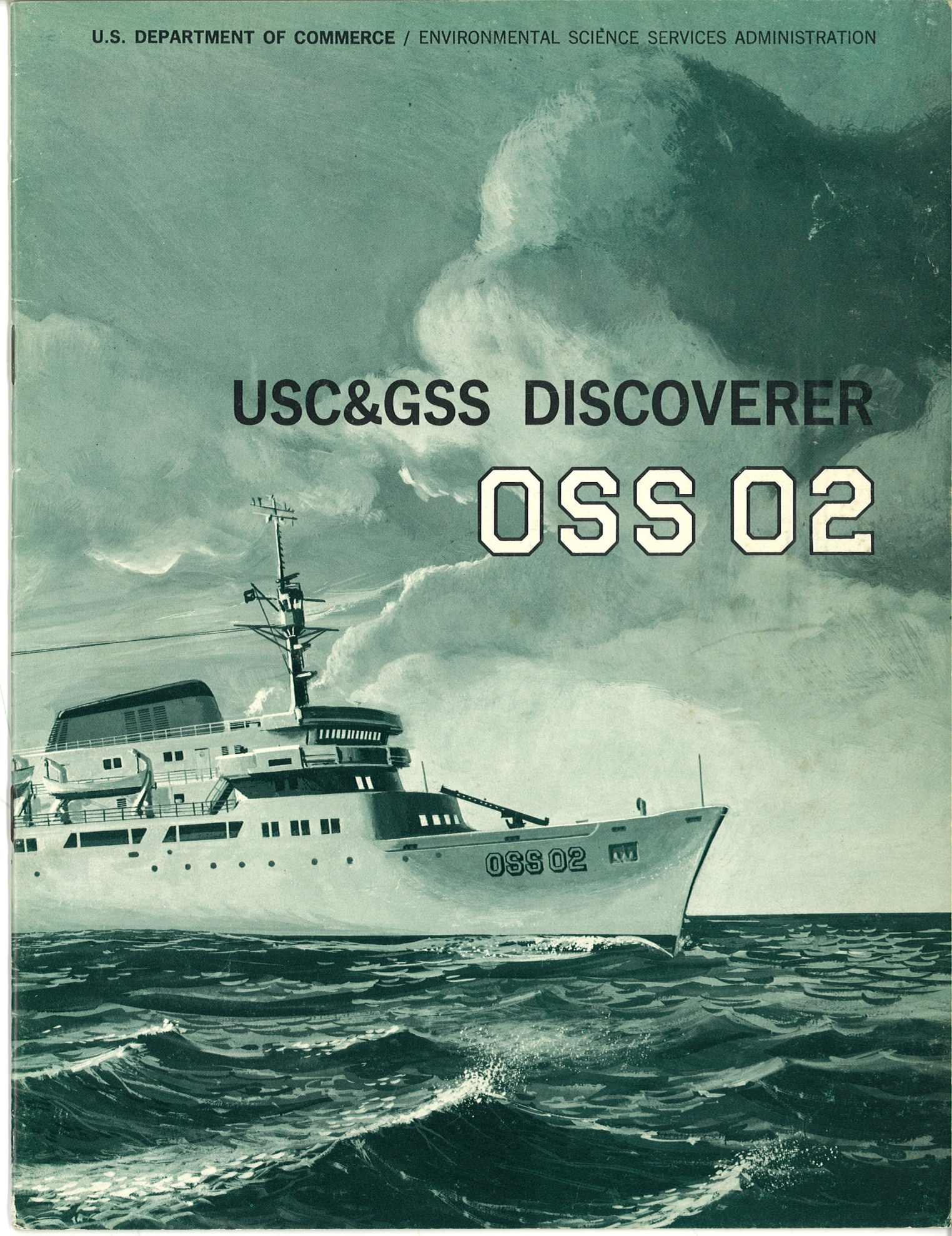
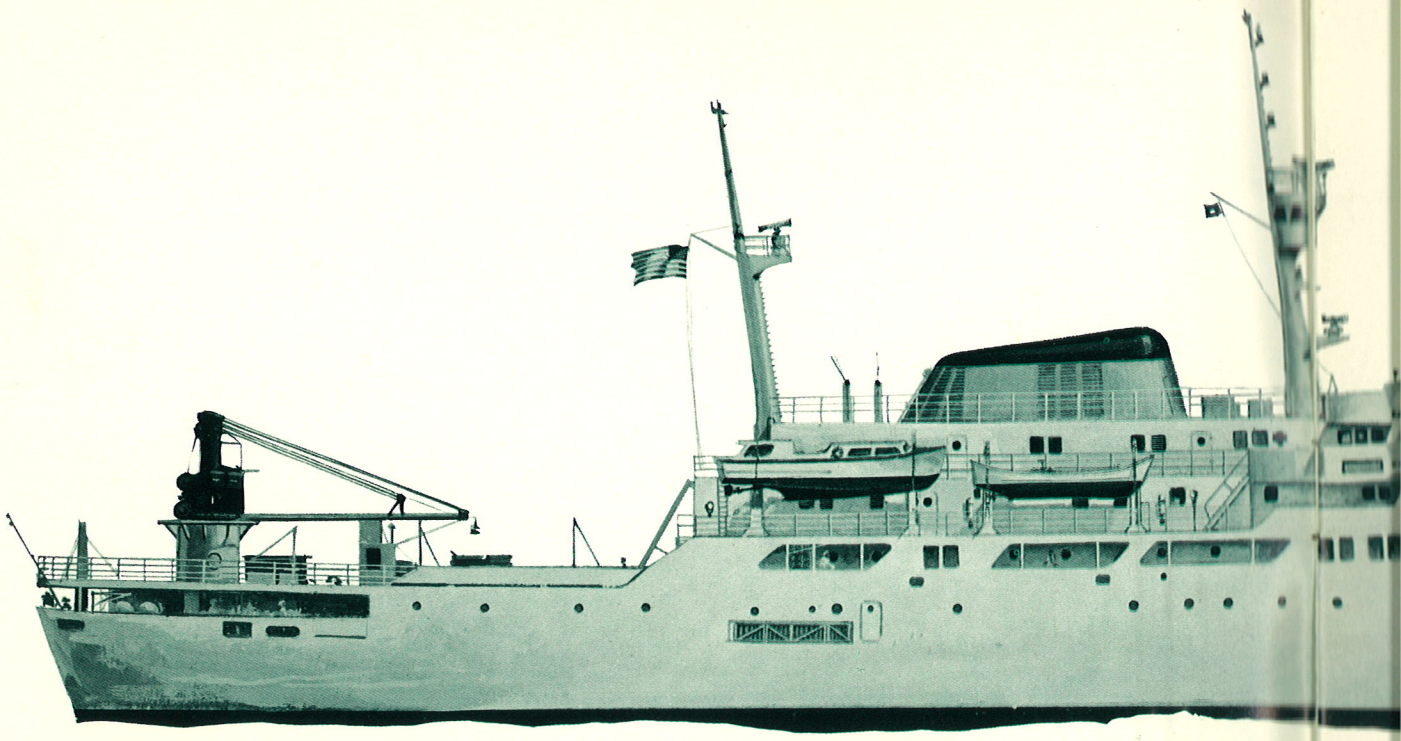
U.S. DEPARTMENT OF COMMERCE / ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

USC&GSS DISCOVERER

OSS 02





A message from the Administrator Environmental Science Services Administration

On July 13, 1966, the USC&GSS *Oceanographer* was commissioned. At that time, she was the largest vessel ever constructed in the United States specifically to conduct environmental research. Her preeminence in size was matched by the imagination with which automated systems were integrated in the ship's mission and design, and by her splendid oceanographic capability.

Since the commissioning of the USC&GSS *Discoverer,* in 1967, the *Oceanographer* has had a strong competitor—and ally. These two sister ships are virtually identical in size, design, and capability. They are the largest and most modern members of a fleet of research vessels used by ESSA, the Environmental Science Services Administration.

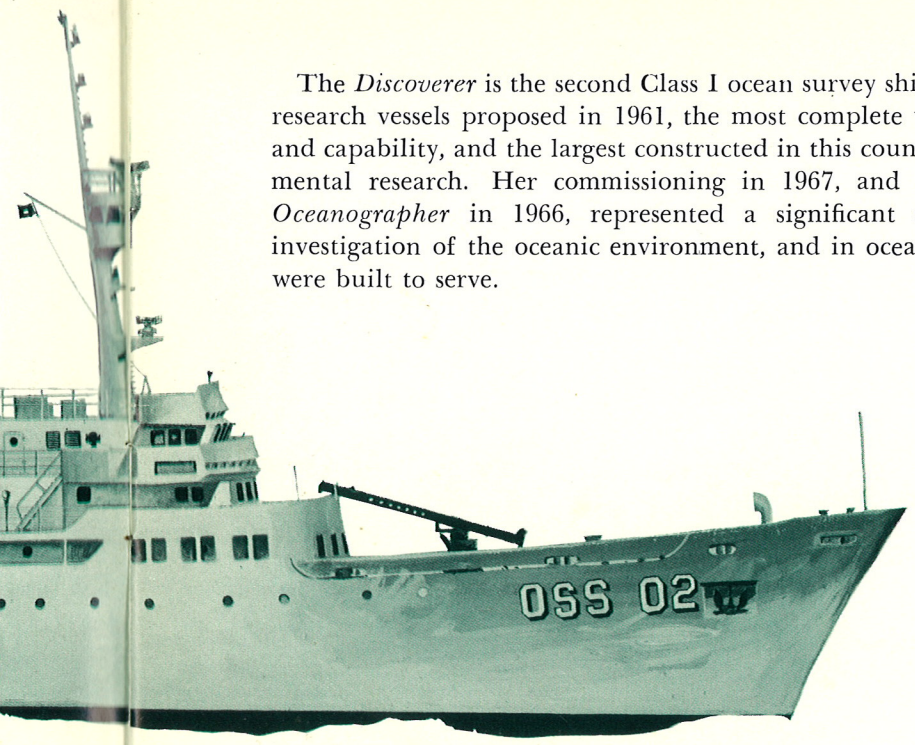
Oceanographer has moved to her permanent station in Seattle; the Pacific will be her province of investigation. *Discoverer* will advance man's knowledge of the rich lands along the Atlantic continental margins, and the unknown reaches of the sea's abyssal depths. Between them, these sister ships will help improve man's understanding and uses of the vast rich ocean—and his prospects for survival on a crowded planet.

Robert M White

1967

ESSA/PI 670001

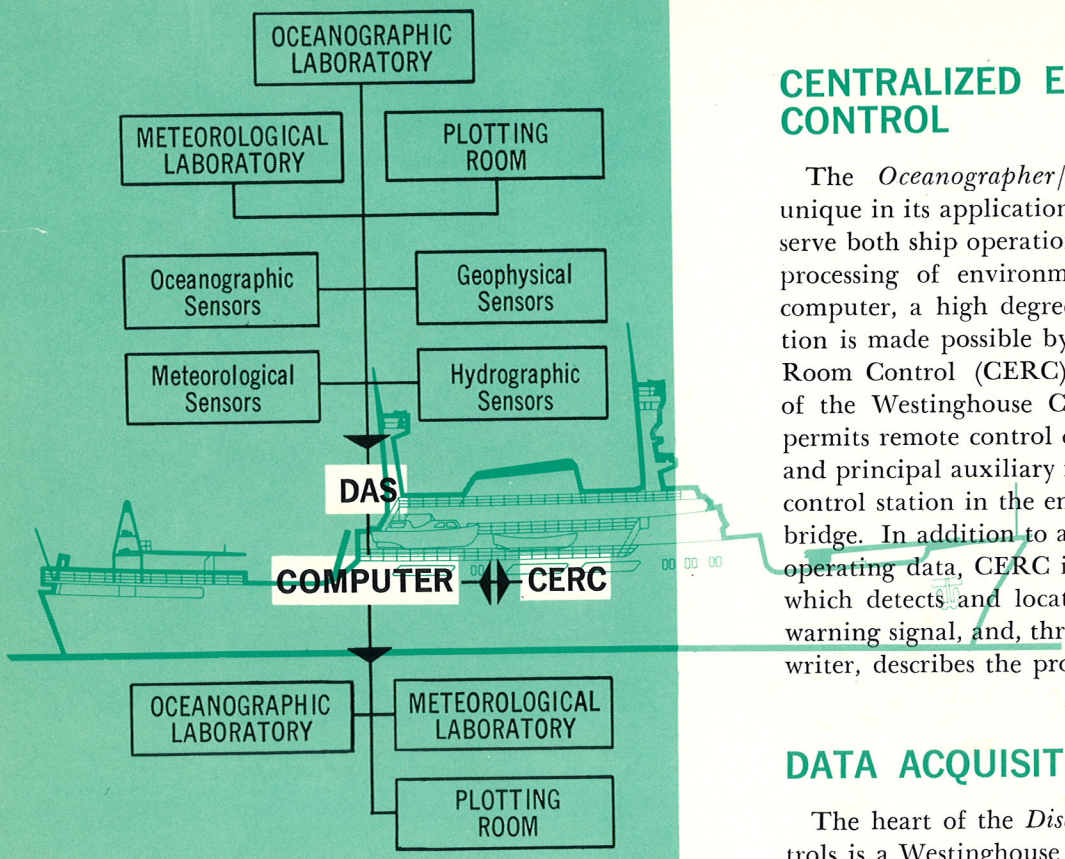
The *Discoverer* is the second Class I ocean survey ship of the new generation of research vessels proposed in 1961, the most complete with respect to equipment and capability, and the largest constructed in this country specifically for environmental research. Her commissioning in 1967, and the commissioning of the *Oceanographer* in 1966, represented a significant advance in this Nation's investigation of the oceanic environment, and in oceanography, the science they were built to serve.

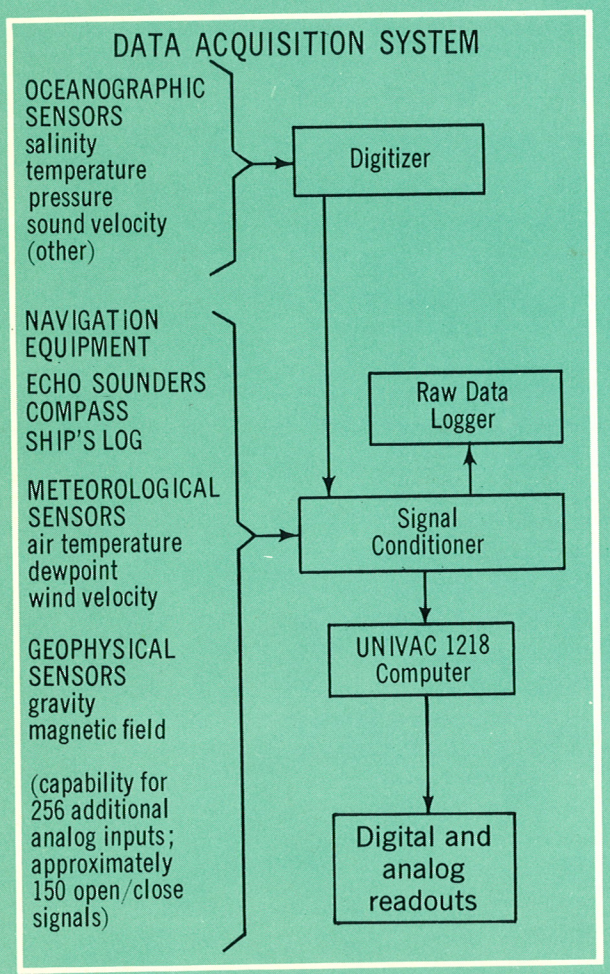


The USC&GSS *Discoverer*—OSS 02—was designed by the U. S. Maritime Administration and built under its supervision. The keel for the new research ship was laid at the Aerojet-General shipyard, Jacksonville, Fla., on September 10, 1963. The *Discoverer* was launched October 29, 1964, delivered to ESSA's Coast and Geodetic Survey December 15, 1966, and commissioned in mid-1967.

The ship combines a full environmental research capability with unique features of design—versatility in handling scientific gear over the side; an extensive use of automated control and data systems; radio, radar, and satellite navigation equipment; a research-oriented arrangement of living quarters, laboratories, and oceanographic work area; and planned growth capability.

The *Discoverer* is operated and commanded by the Coast and Geodetic Survey, one of ESSA's major elements. The scientific staff includes scientists from the Institute for Oceanography, one of ESSA's Institutes for Environmental Research. The *Discoverer*'s operations are characterized by close cooperation with university marine researchers. On each research or survey expedition, guest scientists carry out research work in conjunction with scientists from the Institute for Oceanography.





CENTRALIZED ENGINE ROOM CONTROL

The *Oceanographer/Discoverer* design was unique in its application of a single computer to serve both ship operation and the collection and processing of environmental data. Using this computer, a high degree of machinery automation is made possible by the Centralized Engine Room Control (CERC) system, a development of the Westinghouse Corporation. CERC also permits remote control of main propulsion units and principal auxiliary machinery from a master control station in the engine room and from the bridge. In addition to automatic logging of ship operating data, CERC includes an alarm system which detects and locates malfunctions, gives a warning signal, and, through an automated typewriter, describes the problem.

DATA ACQUISITION SYSTEM

The heart of the *Discoverer*'s automated controls is a Westinghouse Prodac 510 system using a UNIVAC 1218 computer main frame. Because controlling and monitoring CERC require only about 25% of the computer's total capacity—100,000 arithmetic calculations per second, 16,384-word memory core—the computer is used principally by the Data Acquisition System (DAS). In its underway mode, DAS samples (via shipboard and towed sensors), records, and processes geophysical, oceanographic, hydrographic, and meteorological data on a routine basis; ship position is logged continuously, and the computer can be used for concurrent processing of nonroutine data. In its on-station mode, DAS samples and processes data sensed by shipboard instruments and by an underwater multisensor package, as well as handling oceanographic station data.

Ordinarily, researchers return from a long voyage to sort and analyze a tremendous bulk of raw data, a routine task which consumes thousands of scientific man-hours. With DAS, environmental data are substantially sorted and processed by the time a voyage is completed, freeing scientists for more productive activities, reducing the unit cost of oceanographic and meteorological data obtained at sea, and cutting the customary lag between acquisition and utilization of these data.

GENERAL DESCRIPTION

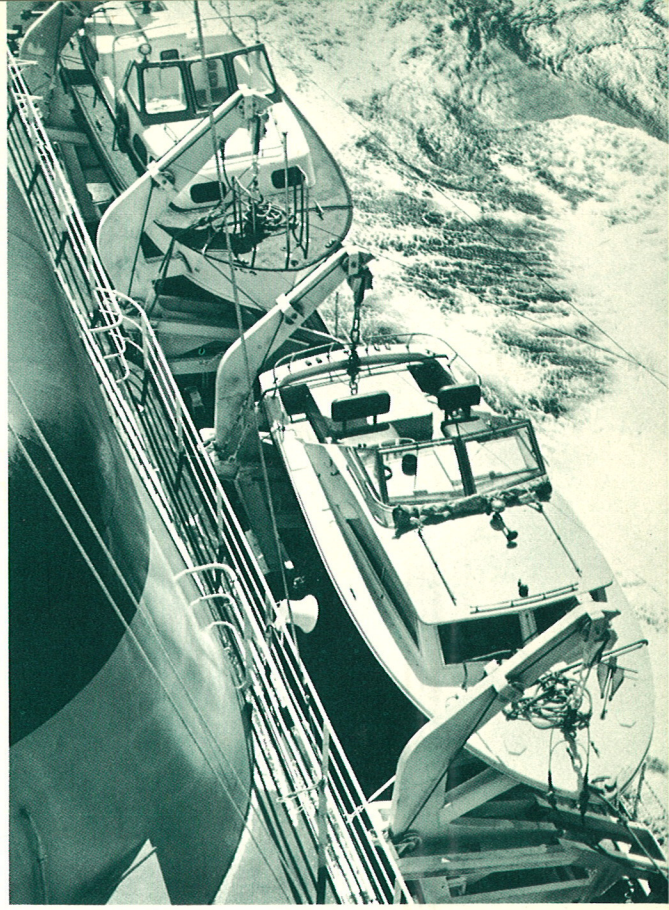
Because she investigates a global oceanic system, the *Discoverer* has a global capability. Her nominal maximum cruising range, at a sustained speed of 16 knots, is 13,000 nautical miles—approximately half the distance around the Equator. The ship can be provisioned for 150 days at sea. Normal fresh-water consumption for all purposes is approximately 5000 gallons per day; storage is available for approximately 27,300 gallons, and distiller capacity is 8000 gallons per day.

The *Discoverer* is of welded steel construction with structural reinforcing for operations in floe ice. All enclosed quarters and work areas are air-conditioned for maximum efficiency during tropical investigations. A passive anti-roll tank permits operations to continue up to Beaufort scale 8—that is, fresh gale conditions, with wind velocity 34 to 40 knots, average wave height 18 feet.

Propulsion is provided by two fixed-pitch propellers driven by two 2500-shp electric motors. A 400-hp bow thruster, developing approximately 10,000 pounds of thrust, is located in a transverse tunnel through the ship's hull, and permits the vessel to maintain a constant heading at slow speeds despite adverse wind and wave conditions. Four 1150-kw diesel generators supply d.c. power to the main propulsion motors, the bow thruster, and the deep sea winch.

Three 400-kw ship service generators supply 450-volt, 60-cycle, 3-phase power for ship service, shops, and laboratories, and maintain constant voltage. Transformers step down normal power to 120-volt, 60-cycle current for lighting, appliances, electronic navigation equipment, and special purposes. Direct current for the gyro compass, automatic telephones, general alarm, and fire detection systems is supplied through batteries and rectifiers. Normal ship service power demand is approximately 400 kilowatts. Shore connections for 450-volt, 3-phase, 400-ampere current are provided.

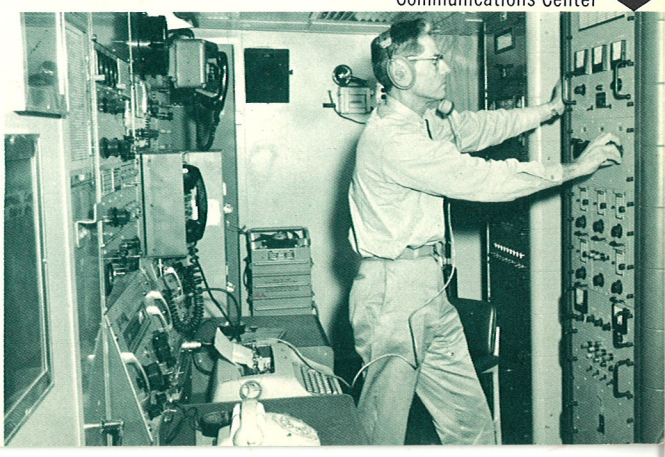
Four auxiliary boats supported on gravity davits are located on the navigation bridge deck. Two of these are 33-foot utility craft, one is a 26-foot motor whaleboat, and one is a 25-foot personnel boat. The survey boats are equipped with communications and shoal-water hydrographic gear.

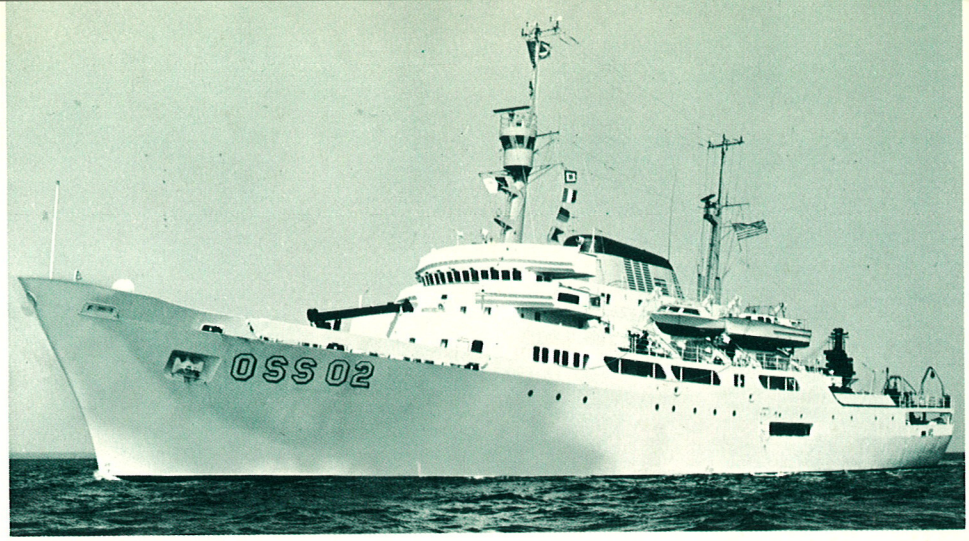


Survey Launches

Engine Room Control

Communications Center





FACILITIES

All enclosed scientific work areas are air conditioned and served by interconnecting wireway trunks and communications, and, although functional, are reasonably spacious. The design objective here was the accommodation of the projects of visiting scientists as well as ESSA investigations.

The oceanographic laboratory is a rectangular area occupying the entire aft end of the main deck. Net work area is 3400 square feet, excluding the laboratory office and data center room. Modular laboratory furniture permits flexible arrangement of the central work area to suit individual projects. Contiguous wet and dry labs are located in the aft, starboard corner of the oceanographic laboratory; both open on the central work area.

A 6 by 8 foot vertical center well with a pressurized viewing port extends from the laboratory through the ship's hull and can be used by SCUBA divers and for casts of special equipment. A hatch and handling gear for the center well are located above the well on the superstructure deck. A monorail loop passes near the main deck hatch of the center well, and serves the laboratory and adjoining fantail work area.

Other laboratory facilities include salt water, hot and cold fresh water, bottled gas, compressed air, 120-volt a.c. general service, and 450-volt, 3-phase, 60-cycle power; d.c. power is available from wet-cell batteries. Space and power for portable core freeze-boxes are available in the laboratory.

Indicators in the oceanographic laboratory show ship course and speed, gravity measurements, and readings obtained from other sensing instruments installed at various locations on the ship. Winch repeaters indicate winch speed, line tension, and quantity of line deployed during oceanographic operations. Gravity, seawater surface temperature, variations in magnetic field intensity, and water depth are recorded in the laboratory. Laboratory equipment includes a spectrophotometer, GEK (geomagnetic electrokinetograph), seismic reflection profiler, salinity bridge, and the equipment normally found in seagoing oceanographic laboratories. The computer is located in the laboratory's data center.

The meteorological laboratory is immediately forward and above the oceanographic laboratory and provides 160 square feet of work space on the port side of the superstructure deck. The office is equipped with radiosonde receiver and repeaters for seawater temperature, wind velocity, and ship's course and speed. The ship can receive Environmental Survey SAtellite (ESSA) photographs through an APT (Automatic Picture Transmission) receiver system. Space for meteorological sounding rocket equipment is also available. The meteorological office adjoins the balloon inflation room and the meteorologists' stateroom.

The plotting room is located aft of the pilot house on the navigation bridge deck, and offers 530 square feet of useful space. Equipment includes two stabilized narrow-beam sonar system recorders, a course recorder driven by the gyro compass, two conventional recorders driven by the deep-water sonar, a Decca 838 buoy-tracking radar, one recorder driven by the shoalwater sonar, the RCA 8714 radio direction-finder receiver, satellite navigation system, and two Loran "C" receivers. The Loran "A" receiver is located between the plotting room and pilot house.

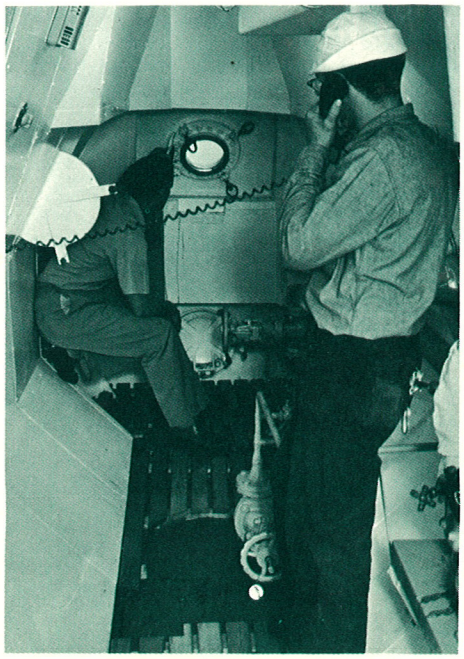
Other laboratory and work facilities include a gravity laboratory with 150 square feet of usable space, a photographic laboratory with 165 square feet of usable space, instrument repair shop, and an electronics repair shop. A bow observation chamber below the waterline has six ports for underwater viewing forward and to the sides. Two additional pressurized underwater viewing chambers are provided directly beneath the oceanographic working platform.

The *Discoverer* has a nominal complement of 59 officers, scientists, and technicians, and 39 crew. Additional staterooms are available for eight visiting scientists, a distinguished guest, and eight unassigned crew, and there are three spare berths. The ship can accommodate as many as 116 persons.

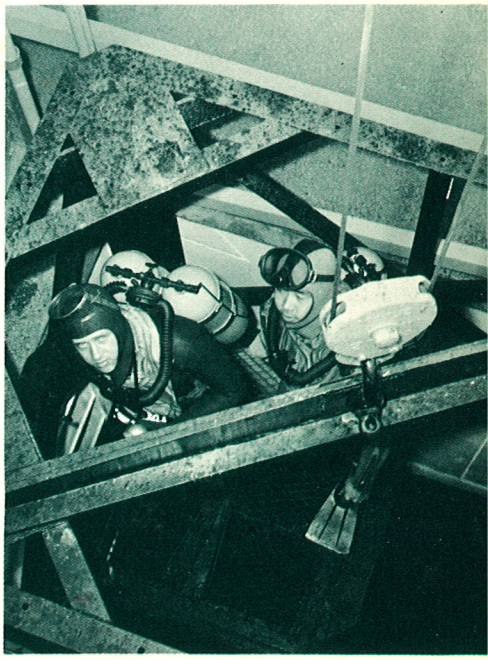
Much attention has been given to developing a living and working environment aboard the *Discoverer* that is conducive to good morale and productive operations. General staterooms with adjoining individual day rooms and facilities are provided for the captain, chief engineer, and any distinguished guest. Single staterooms are provided for senior officers and eight chief petty officers. Remaining staterooms are double. Individual lounges are provided for officers and scientists, chief petty officers, and petty officers and crew. The arrangement of ship's accommodations permits participation of women guest scientists who have often been excluded from important expeditions by the austerity and lack of privacy characteristic of working vessels.

Capt. William F. Deane, USESSA Commanding

Bow Observation Chamber



Divers on Center Well Platform



COMMUNICATIONS EQUIPMENT

Main transmitter, RCA ET-8017, IF on 10 frequencies.

Transmitter, RCA ET-8063, HF single sideband, 50 frequencies in five bands cover 2-30 Mc, with RCA RM-334 remote HF receiver.

Main radio receiver, RCA CRM-R2A, HF and IF single sideband, 18 bands cover 80-kc-30 Mc.

Emergency transmitter, RCA ET-8043, MF 350-515 kc.

Emergency receiver, RCA AR-8510, LF, four bands cover 15-650 kc.

Automatic alarm signal unit, RCA AR-8603.

Two receivers, Collins, 30 bands cover 0.54 -30.5 Mc for AM, CW, MCW, SSB, and FSK reception.

Transceiver, Collins 32 RS-1, HF single sideband 1.6-15Mc.

Transceiver, Collins KWT-6/8, MF and HF, 2-30 Mc, with Collins 40N-1 frequency standard.

Radiotelephone, RCA CRM-P7A-150, 2-9 Mc, emergency transmission on 2182 kc.

Auxiliary radiotelephone, RCA ET-8058, VHF, six frequencies cover 144-174 Mc, arranged for duplex operation with RCA AR-8519 receiver.

Base station, Motorola "Compa-Station," VHF, reception and transmission on 164.025 and 164.075 Mc.

Facsimile equipment, Alden 311 DA, with RCA CRM-55B receiver.

Standard frequency broadcast service (WWV) communication receiver, RCA AR-8516, AM and CW, 18 bands cover 80-kc-30 Mc, with time-signal circuit.

Radio teletype, operating with Collins KWT-6/8 single sideband transceiver and two Collins 51S-IHF communication receivers.

APT (Automatic Picture Transmission) receiver, for weather satellite transmissions.

Lifeboat transmitter/receiver, portable, RCA ET-8053.

Transceivers, mobile, Collins 32MS-1A HF single sideband, 1.6-15 Mc, one in each 33-foot oceanographic survey launch.

Radiotelephones (4), portable, Motorola P-33, VHF, 164.025 and 164.075 Mc.

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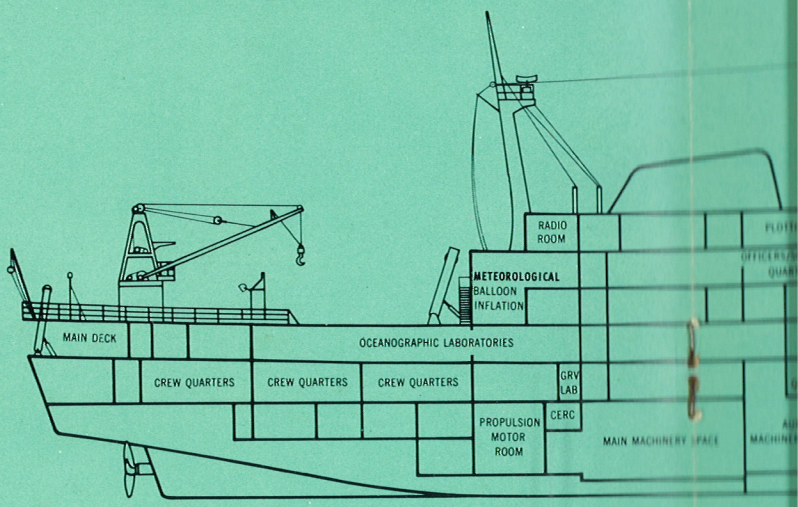
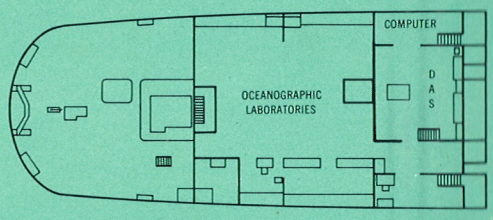
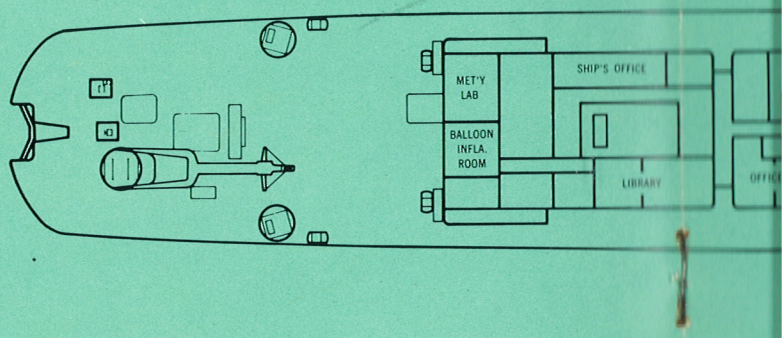




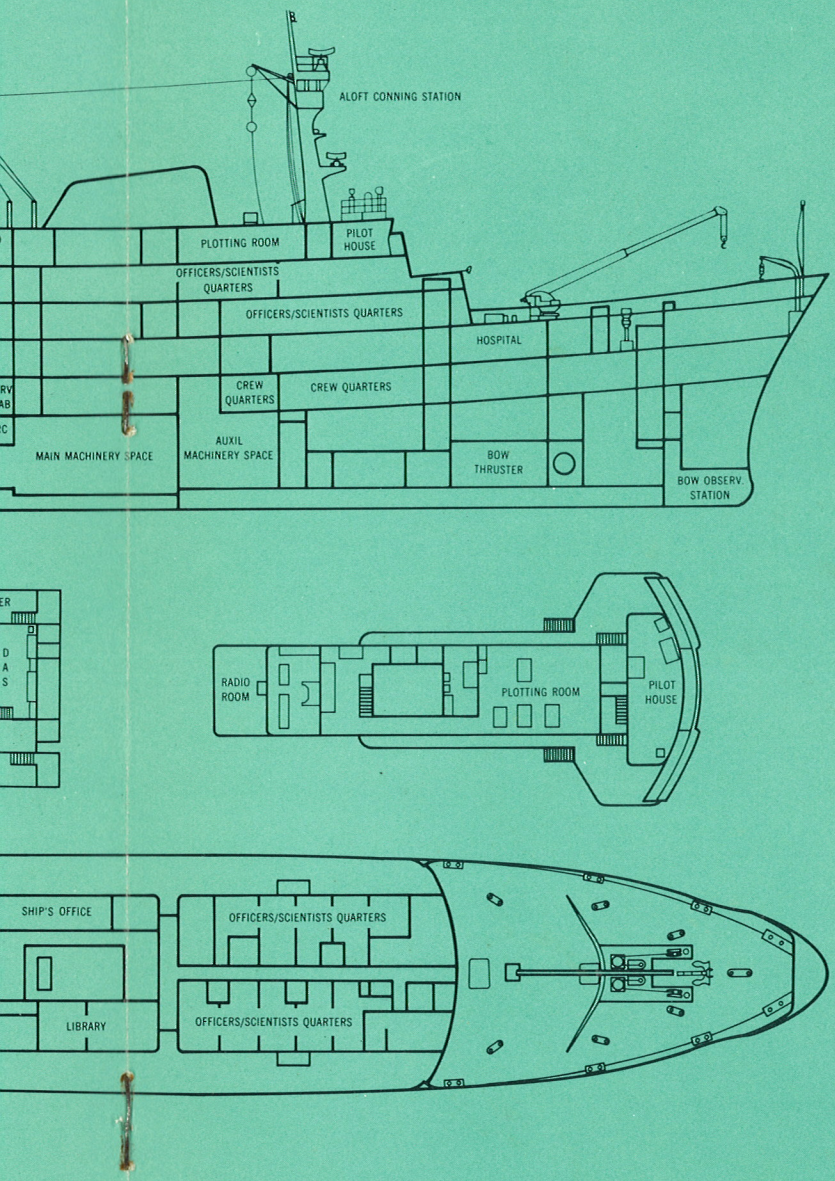


UNDERWATER SOUNDING EQUIPMENT

Deep-water sonar, AN/UQN 1-E, EDO Model 185, transducers at bow and one-third length, two conventional recorders and two PDRs in plotting room.

Shoal-water sonar, DE 723, pair of transducers amidships and port and starboard at the forward one-third length,

SCOVERER OSS 02



GENERAL CHARACTERISTICS

Length, overall	303 feet
Length, waterline	280 feet
Beam, molded	52 feet
Depth at side, molded	28 feet 6 inches
Draft, light	13 feet
Draft, full load	18 feet
Displacement, light	2580 long tons
Displacement, full load	3805 long tons

NAVIGATION EQUIPMENT

Gyro compass, Sperry MK 14, Mod 3, modified for 80° latitude, course recorders in plotting room, synchronous information to eight shipboard stations.

Gyro automatic pilot.

Navigation radar, Decca TM-707, in pilot house.

Navigation radar, Decca 969 with ARp-50 plotter, in pilot house.

Loran "A," Sperry MK 2, Mod 2A, 2 Mc, hyperbolic, receiver between pilot house and plotting room, maximum range 750 miles, positional accuracy 1.0% of ship's distance from shore stations.

Loran "C," AN/SPN-32, 100 kc, hyperbolic, two receivers in plotting room, maximum range 1500 miles, positional accuracy 0.1% of ship's distance from shore stations.

Radio direction-finder, RCA 8714, receiver in plotting room.

Radio direction-finder, portable, RCA CRM-DIA.

Satellite navigation system.

A deep-sea, 150-hp electro-hydraulic winch with 45,000 feet of tapered (¾ to ⅜ inch) wire is located on the aft main deck. Two double-drum, 30-hp, electro-hydraulic winches with 30,000 feet each of $\frac{3}{16}$-inch wire and 12,000 feet of 6-conductor electrical logging cable are installed on the aft superstructure deck. A 40-hp electro-hydraulic winch with 6000 feet of ⅜-inch wire is located on the aft superstructure deck, and three bathythermographic winches are carried, two on the aft main deck and one on the forward boat deck. The forward crane has a 7300-pound capacity at a 40-foot radius; the aft crane has a capacity of 5 long tons at a 35-foot radius, and is mounted off-center to handle long cores. Direct pilot-house control of the main engines and bow-thruster is provided.

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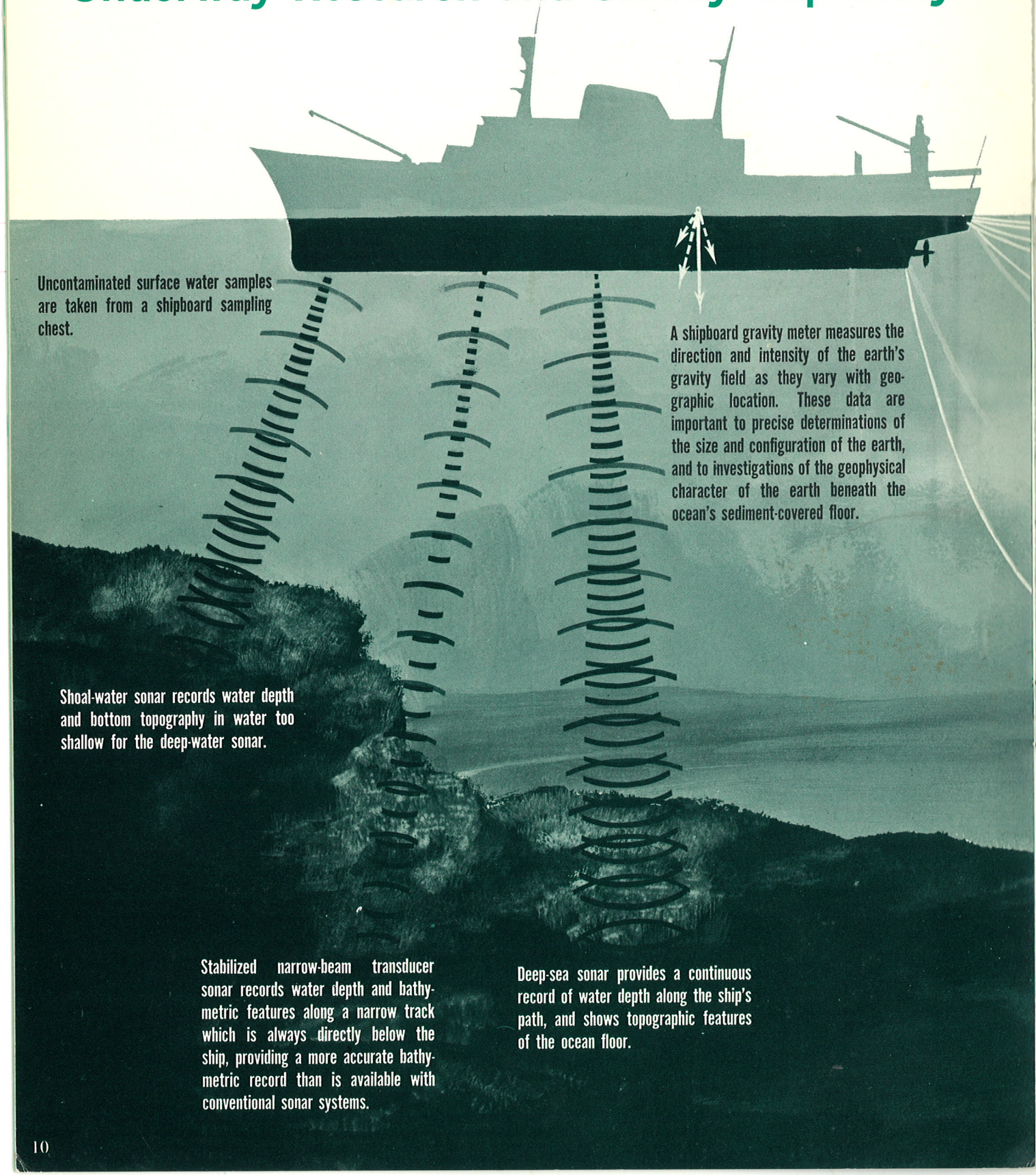
one Fathometer recorder each in plotting room, pilot house, and oceanographic laboratory.

Lodar, Elac LSE–30 (horizontal/vertical sonar) with LAZ 17 recorder, in pilot house.

Narrow-beam stabilized transducer sonar, 6,000-fathom range, recording on two PDR's in plotting room; the beam is always directed toward earth center regardless of ship's motions.

Underway Research and Survey Capability



Uncontaminated surface water samples are taken from a shipboard sampling chest.

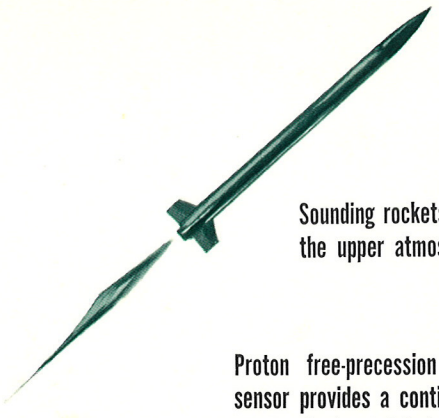
A shipboard gravity meter measures the direction and intensity of the earth's gravity field as they vary with geographic location. These data are important to precise determinations of the size and configuration of the earth, and to investigations of the geophysical character of the earth beneath the ocean's sediment-covered floor.

Shoal-water sonar records water depth and bottom topography in water too shallow for the deep-water sonar.

Stabilized narrow-beam transducer sonar records water depth and bathymetric features along a narrow track which is always directly below the ship, providing a more accurate bathymetric record than is available with conventional sonar systems.

Deep-sea sonar provides a continuous record of water depth along the ship's path, and shows topographic features of the ocean floor.

Atmospheric conditions are monitored at regular intervals with ship-launched radiosonde balloons, which send temperature, pressure, and humidity data to a receiver in the meteorological laboratory; by tracking the balloon, observers can determine wind conditions aloft.



Sounding rockets will be used to probe the upper atmosphere and ionosphere.

Towed GEK (geomagnetic electrokinetograph) sensor measures surface current velocity by measuring the interaction of the ocean and the earth's magnetic field.

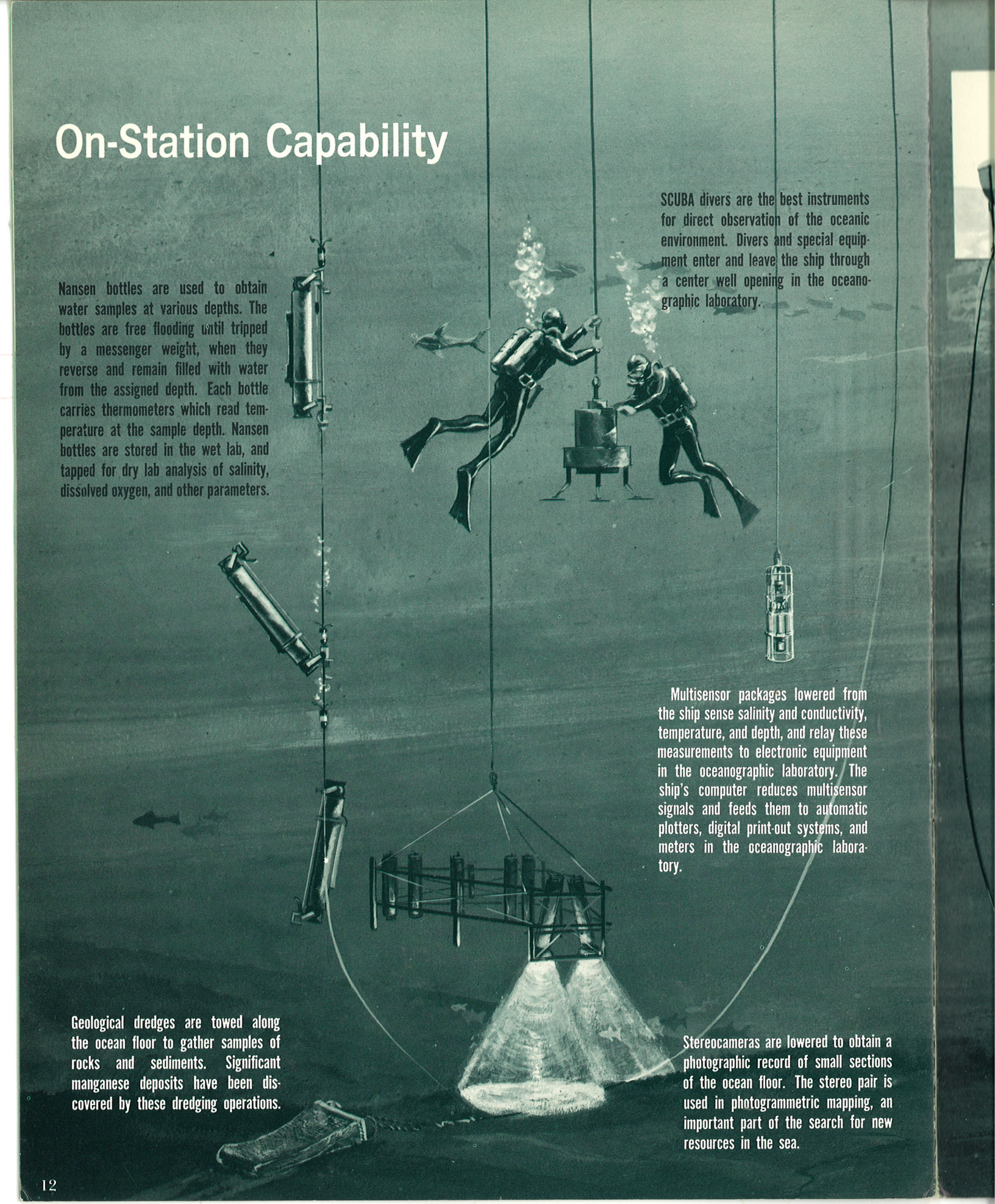
Proton free-precession magnetometer sensor provides a continuous measurement of the total intensity of the earth's magnetic field.

Biological nets are towed at reduced speeds, gathering samples of plankton and other organisms which are basic to the food chain in the sea.

Bathythermographic sensors record water temperature as a function of depth.

A seismic reflection profiler uses a "sparker" towed astern to direct a low-frequency sonic signal toward the ocean floor; the reflected signal is picked up by the towed hydrophones and recorded. The recorded profile is similar to conventional sonar sounding records, with the difference that the low-frequency signal penetrates bottom sediments and rock structure to a considerable depth. Continuous profiles can be obtained along the ship's track.

On-Station Capability



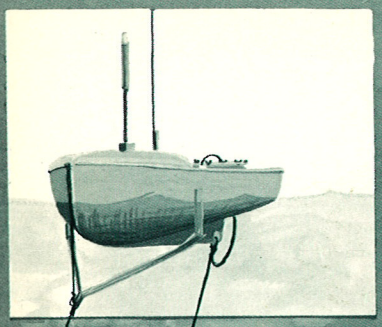
Nansen bottles are used to obtain water samples at various depths. The bottles are free flooding until tripped by a messenger weight, when they reverse and remain filled with water from the assigned depth. Each bottle carries thermometers which read temperature at the sample depth. Nansen bottles are stored in the wet lab, and tapped for dry lab analysis of salinity, dissolved oxygen, and other parameters.

SCUBA divers are the best instruments for direct observation of the oceanic environment. Divers and special equipment enter and leave the ship through a center well opening in the oceanographic laboratory.

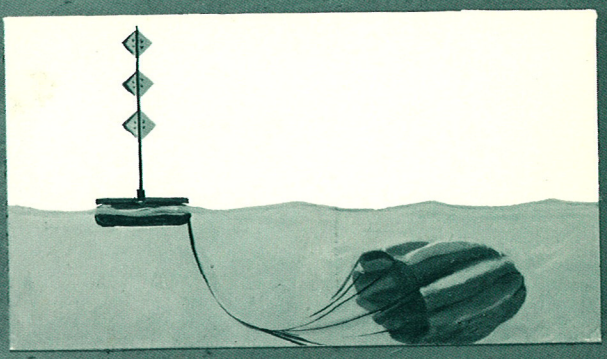
Multisensor packages lowered from the ship sense salinity and conductivity, temperature, and depth, and relay these measurements to electronic equipment in the oceanographic laboratory. The ship's computer reduces multisensor signals and feeds them to automatic plotters, digital print-out systems, and meters in the oceanographic laboratory.

Geological dredges are towed along the ocean floor to gather samples of rocks and sediments. Significant manganese deposits have been discovered by these dredging operations.

Stereocameras are lowered to obtain a photographic record of small sections of the ocean floor. The stereo pair is used in photogrammetric mapping, an important part of the search for new resources in the sea.



Instruments suspended from a ship-launched buoy measure direction and speed of ocean currents and water temperature and conductivity. Buoy instrumentation relays these measurements by radio to shipboard or shore-based receivers. The ODESSA (Ocean Data Environmental Science Service Acquisition) system shown here is a forerunner of more advanced deep-water devices—a necessary development if man is to understand fully the dynamics of the global sea.



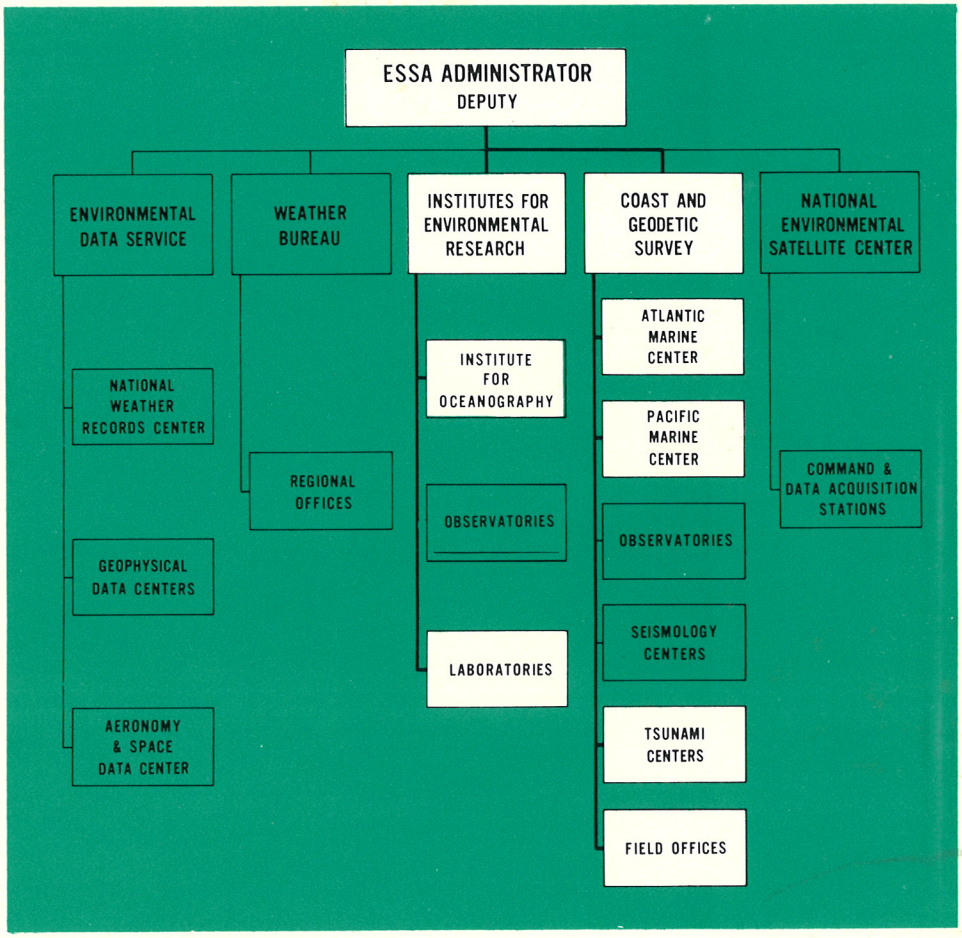
Drogue buoys, deployed by the ship and tracked by radar, measure current flow at depth.

Samples of ocean floor sediments are collected for analysis, and are used in determinations of the character, age, and origin of the ocean basins and continents.

Grabs take a "bite" from the exposed sediment layer.

Long cores are obtained with tubular devices which are driven into the sediment layers. When brought aboard ship, the core samples are removed intact as cylindrical specimens showing the vertical composition of the ocean bottom. Core sizes of this type range to more than 100 feet in length, and have been collected even in the deepest ocean trenches.

Thermoprobes are driven into the ocean floor to read temperatures at various vertical positions in the sediment layer. These measurements are used to determine the flow of heat from the earth into the ocean, providing clues to the seismic and structural character of the earth beneath the ocean floor.



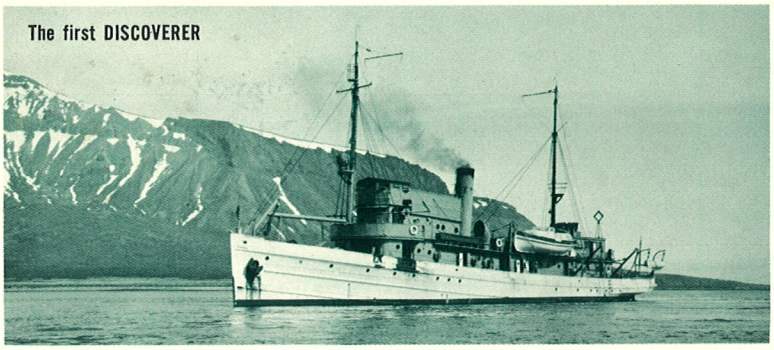
OCEANOGRAPHY AT ESSA

Formation of ESSA in 1965 brought together the functions of the Coast and Geodetic Survey and the Weather Bureau, which became two major elements of the agency, and created new functions, embodied in the Environmental Data Service, National Environmental Satellite Center, and the Institutes for Environmental Research. The Central Radio Propagation Laboratory, formerly of the National Bureau of Standards, became the Institute for Telecommunication Sciences and Aeronomy, joining the Institutes for Earth Sciences, Atmospheric Sciences, and Oceanography. Thus, the talent, equipment, and responsibility needed to conduct a systematic investigation of the total physical environment were combined within a single Federal agency.

The oceanographic phases of ESSA's program are conducted by the Coast and Geodetic Survey and the Institute for Oceanography. The Coast Survey is principally responsible for the operation and maintenance of ESSA's research fleet and facilities and for oceanographic services—hydrographic surveys, measurement of tides and currents, and nautical charting. The Institute for Oceanography conducts ESSA's oceanographic research programs, which include tidal and tsunami investigations, air-sea and land-sea interaction studies, the ocean survey program, and projects in marine geology and geophysics and in physical oceanography.

The interplay between the two functions is apparent: much of the Institute's work is laying the foundation of future, routine operations of the Coast Survey, and the geophysical, oceanographic, and marine geological data gathered during survey operations are studied by Institute scientists.

The Coast and Geodetic Survey and the Institute for Oceanography participate in national and international oceanographic programs, and encourage the joint participation of guest scientists from private institutions, universities, and government agencies. The Institute maintains field facilities in co-location with Coast Survey activities, as, for example, the Pacific Oceanographic Laboratory at the Coast Survey's Marine Center in Seattle, Washington, and the Land-Sea Interaction Laboratory, with the Coast Survey's Norfolk, Virginia, office. The Institute also maintains small, specialized research groups; at present, these include the Joint Tsunami Research Effort, with the University of Hawaii, the Joint Oceanographic Research Group, with the University of Washington, and the Sea-Air Interaction Laboratory. The objective here has been to foster productive environmental research, both as a Federal sponsor and as a full member of the scientific community.



The first DISCOVERER

The first *Oceanographer* was the fabled Morgan yacht, *Corsair II,* renamed for service with the Coast and Geodetic Survey. The present *Oceanographer* carries on a name associated with exotic ships. The *Discoverer* had a less exotic, but harder working, predecessor.

On September 28, 1918, Todd Shipyard Corporation of New York launched a new ship which was commissioned January 31, 1919, the USS *Auk* (AM–38). From April to October, USS *Auk* served with Mine Division No. 3, clearing the North Sea mine barrage. That task accomplished, she returned to New York, and, later in 1919, was placed in reserve at Portsmouth, New Hampshire.

USS *Auk* was transferred to the Coast and Geodetic Survey on April 7, 1922, and given a name which matched her new assignment: *Discoverer.* From 1922 to 1926, the *Discoverer* helped the Coast and Geodetic Survey carry out the hydrographic surveys which opened coastal shipping lanes along Alaska. Discoverer Island and Discoverer Bay, off the Alaska Peninsula, were named for this hardworking ship. In 1927, the *Discoverer* was transferred to hydrographic work in the Hawaiian Islands, surveyed the coast of California in 1928 and 1929, and returned to Alaskan waters until 1940.

On August 26, 1941, the ship returned to the Navy and underwent conversion to a salvage vessel (ARS–3), but retained the name *Discoverer.* She served civilian crews during World War II. On January 28, 1947, her quiet career of faithful service over, this first *Discoverer* was stricken from the Naval Vessel Register.

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